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[54] **TRIGGER PULL MEASURING DEVICE FOR AND METHOD OF IMPROVING TRIGGER PULL TECHNIQUE**

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[51] **Int. Cl.**[4] **F41F 27/00**

[52] **U.S. Cl.** **434/16;** 42/1.01

[58] **Field of Search** 434/16, 18, 19; 42/1.01, 1.02, 1.03, 1.04

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Primary Examiner—William H. Grieb

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[57] **ABSTRACT**

A trigger pull measuring device adapted for connection to the trigger mechanism of a weapon for measuring the trigger pull of the weapon in order to improve trigger pull technique, comprising a variable resistor having a sliding contact for varying the resistance of the resistor, connected to a voltage source, and a linkage for connecting the sliding contact of the variable resistor to the trigger mechanism of the weapon so that movement of the trigger moves the sliding contact of the resistor. The device further comprises a battery for applying a voltage across the variable resistor and a chart recorder for measuring and displaying the resistance across the variable portion of the variable resistor to measure the position of the trigger.

The method of the present invention comprises a method of improving trigger pull technique for firing a weapon with a trigger, the method comprising the steps of continuously measuring trigger displacement as the trigger is pulled and displaying the trigger displacement to the person firing the weapon, to enable the person to correct defects in trigger pull technique.

26 Claims, 2 Drawing Sheets

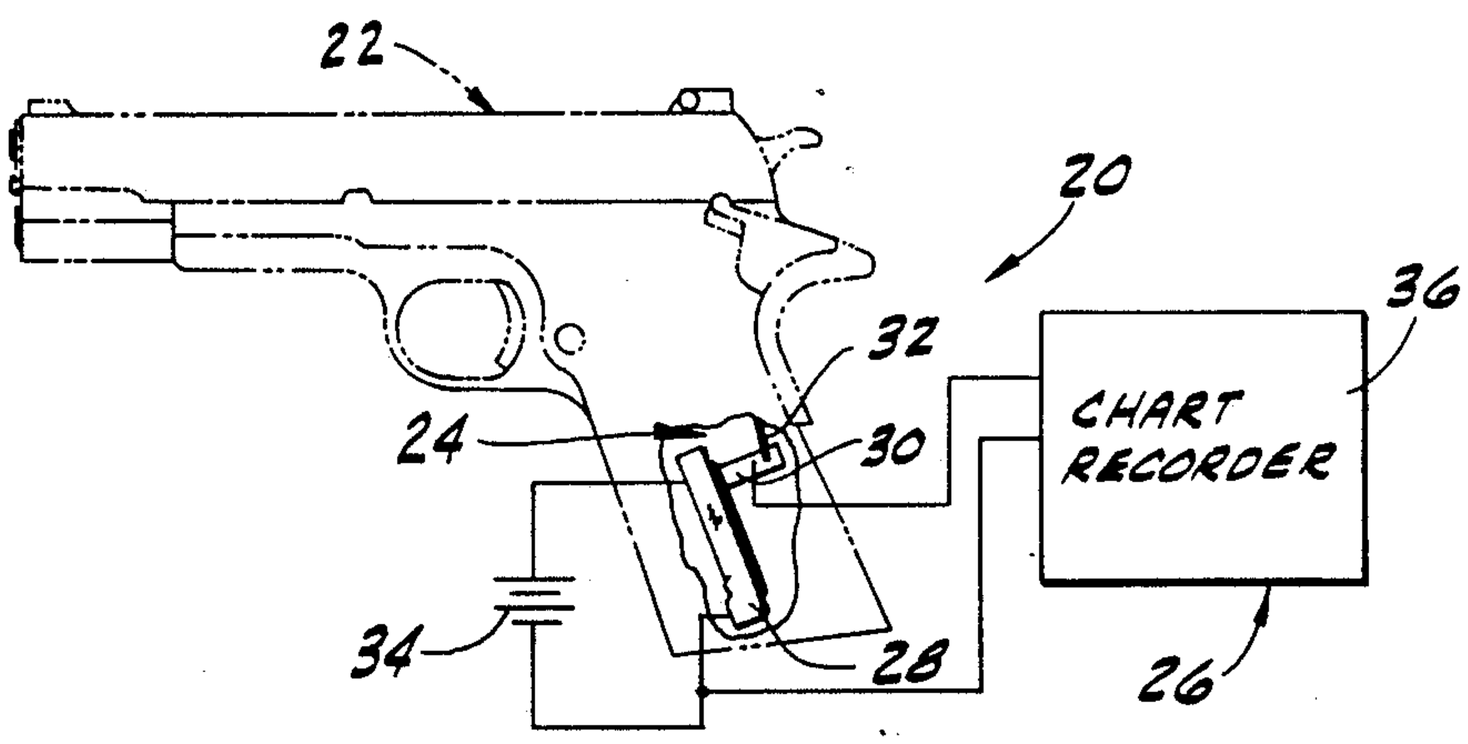


FIG. 1

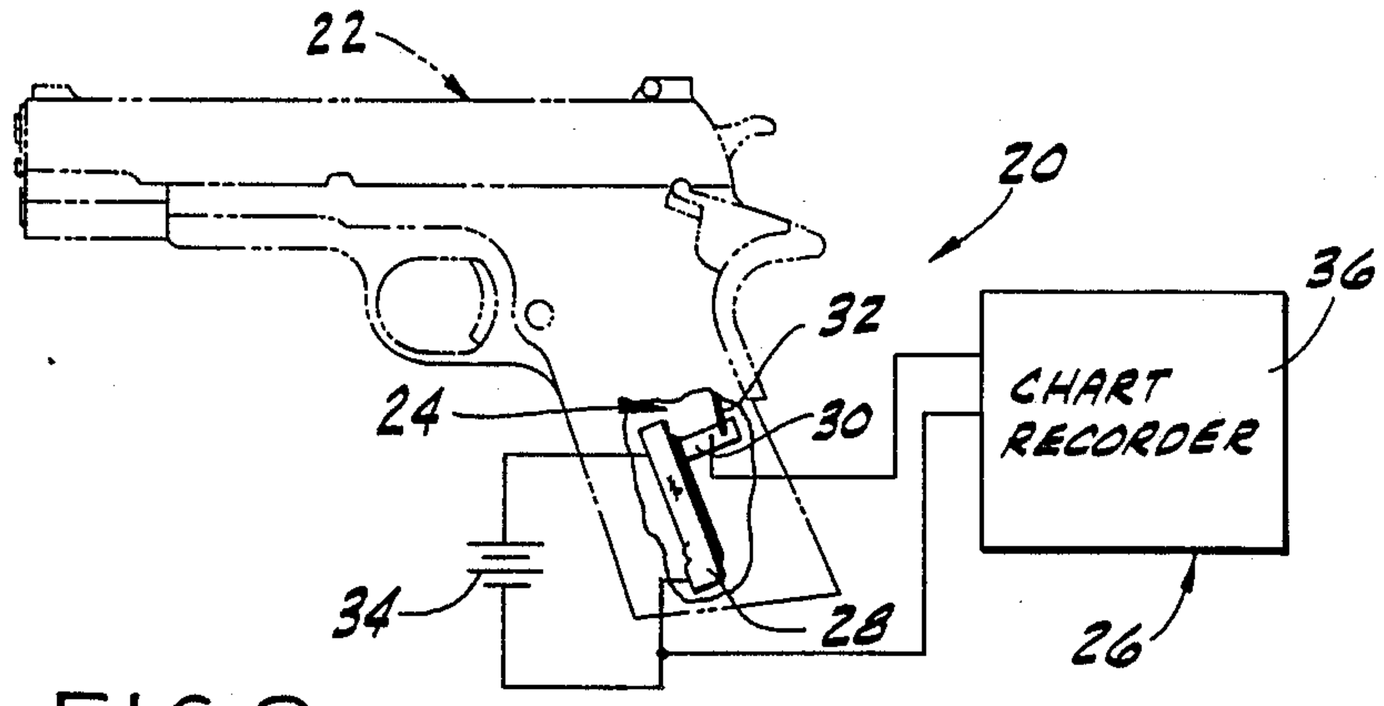


FIG. 2

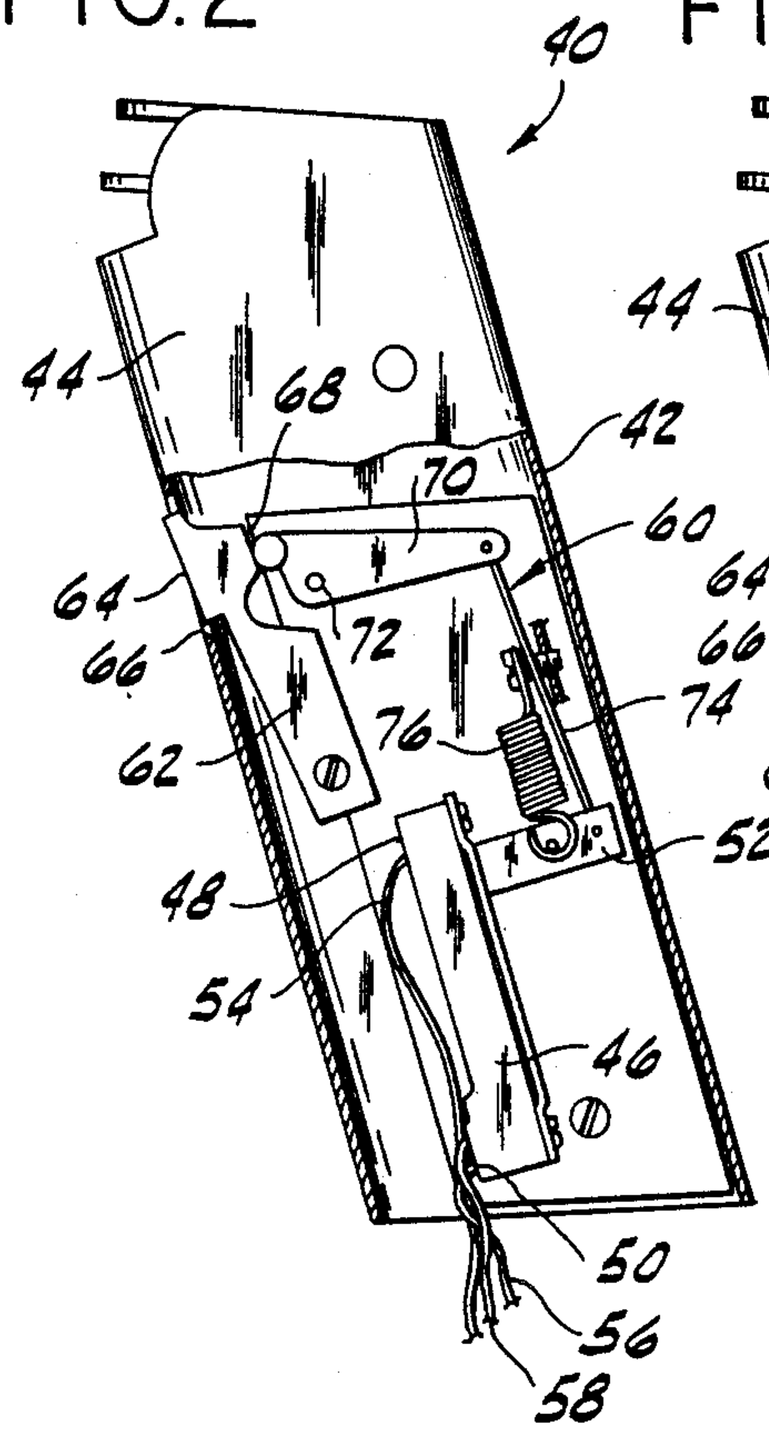
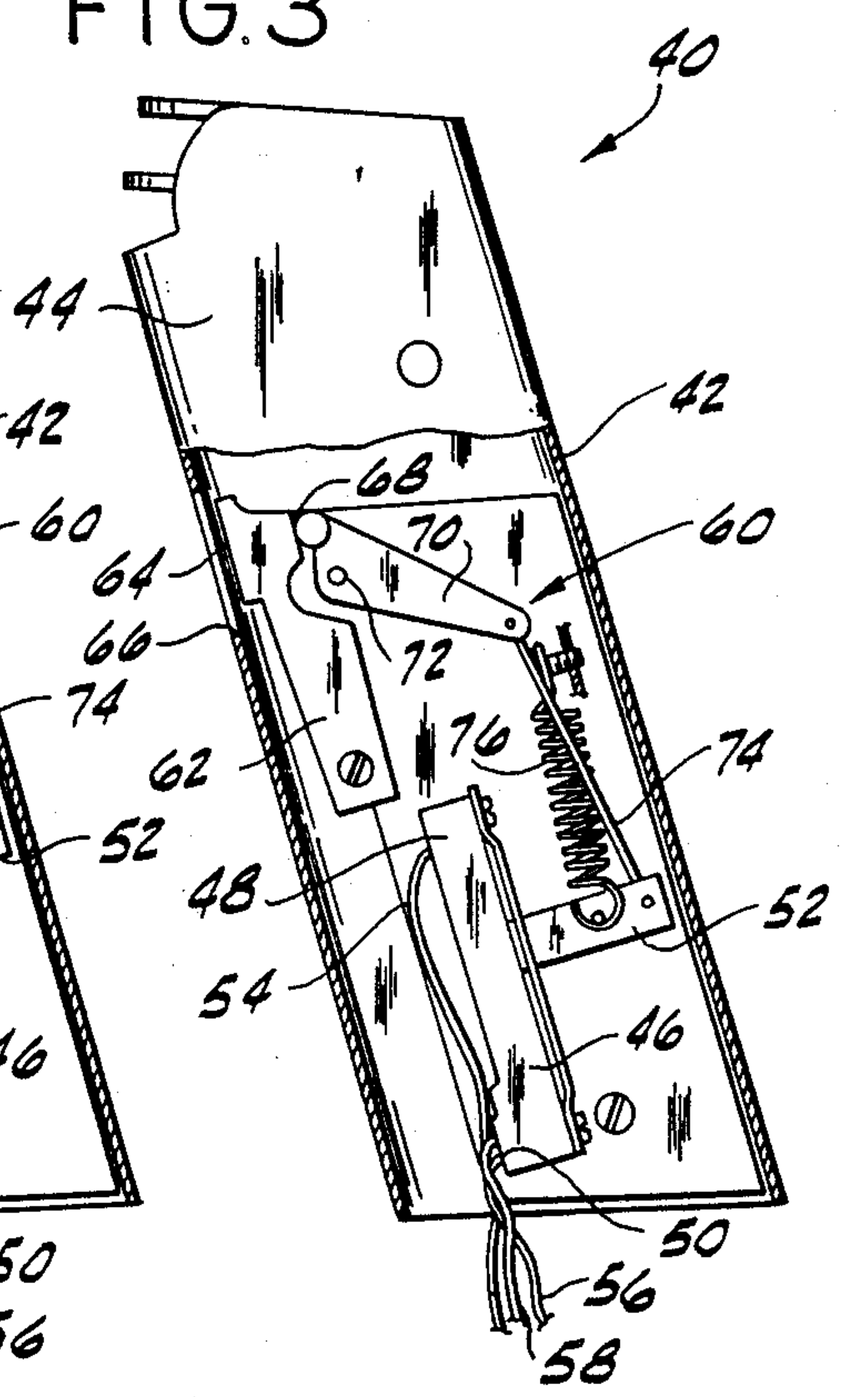


FIG. 3



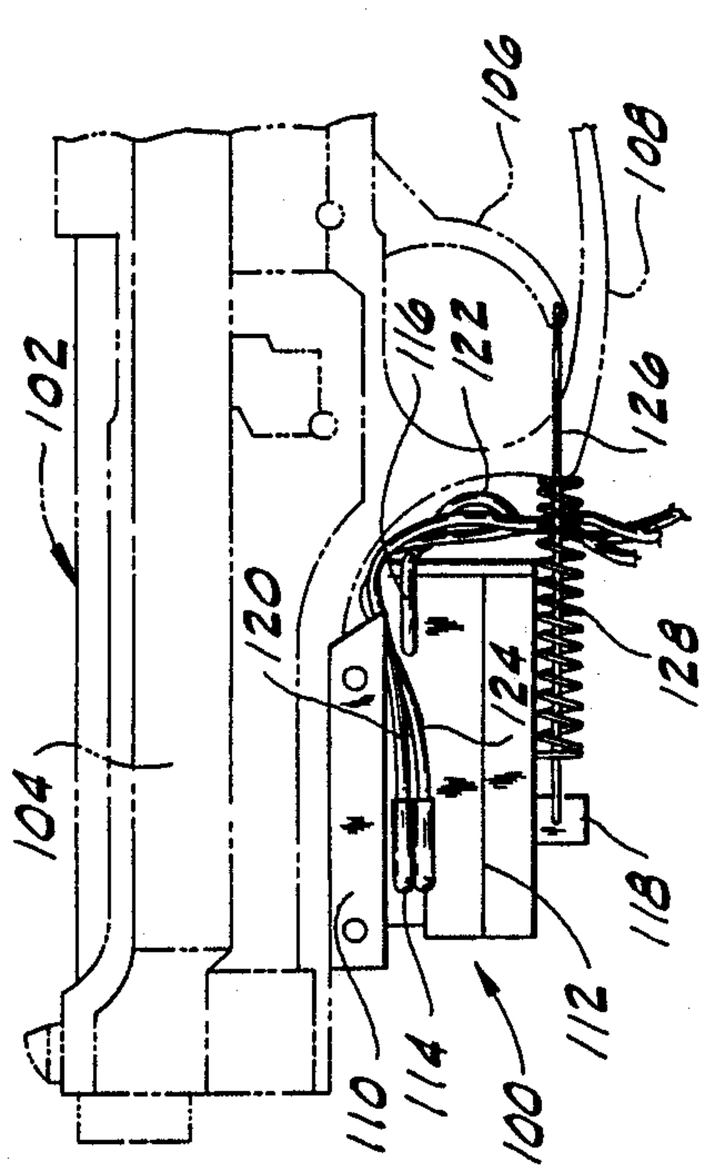

102
104
106
108
110
112
114
116
118
120
122
124
126
128
100

FIG. 4

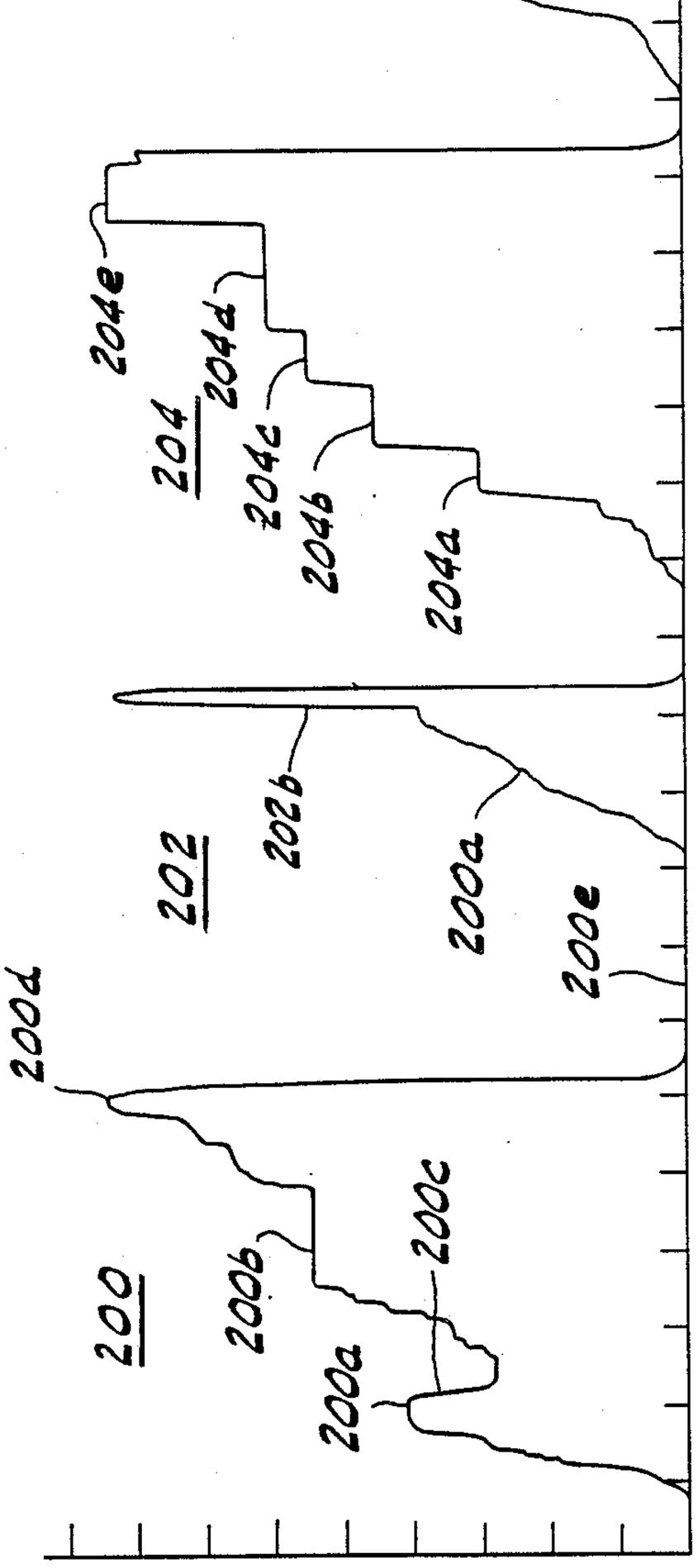

206
204
204e
204d
204c
204b
204a
202
202b
200a
200e
200d
200b
200c
200

FIG. 5

TRIGGER PULL MEASURING DEVICE FOR AND METHOD OF IMPROVING TRIGGER PULL TECHNIQUE

BACKGROUND OF THE INVENTION

This invention relates to weapons training, and in particular to a trigger pull measuring device for, and method of, improving trigger pull technique.

Proper trigger pulling technique is essential for safe and accurate firing of a weapon. Proper trigger pulling technique requires the application of steady pressure to smoothly and steadily move the trigger until the weapon fires. Unsteady trigger motion or jerking of the trigger can ruin the shooter's aim. It is difficult to teach someone how to properly move the trigger smoothly and steadily. Small jerks or breaks in the movement of the trigger are often unperceptible to an observer and even to the shooter.

SUMMARY OF THE INVENTION

It is among the objects of the present invention to provide a device for improving trigger pull technique that displays the trigger movement for the user, and in particular to provide such a device that measures the position of the trigger and continuously displays the position as a function of time. It is also among the objects of this invention to provide such a device that provides a display of the trigger movement to enable diagnosis of defects in the shooter's trigger pulling technique and to provide feedback for the shooter to correct those defects. It is further among the objects of the present invention to provide a method of instructing shooters of the proper trigger pulling technique, and in particular to provide the students with a visual representation of the trigger position as they operate the trigger to improve the shooter's control over trigger movement.

In general the device of the present invention is adapted for connection to the trigger mechanism of a weapon for continuously measuring the rate of motion of the trigger in order to improve trigger pull technique. The device comprises means connected to the trigger mechanism for measuring the position of the trigger and means for displaying the position of the trigger as a function of time.

The means for measuring the position of the trigger preferably comprises a variable resistor having a sliding contact, means for connecting the sliding contact of the variable resistor to the trigger mechanism so that movement of the trigger moves the sliding contact of the resistor, and means for measuring the resistance of the variable resistor (which corresponds to trigger position). The measuring means may comprise means for applying a voltage across the variable resistor and means for measuring the voltage across the variable portion of the resister to measure the position of the trigger.

The means for displaying the trigger position as a function of time preferably comprises a chart recorder for continuously recording the measured voltage across the variable portion of the resistor.

Generally, the method of improving trigger pull technique according to the present invention comprises the steps of continuously measuring trigger position as the trigger is pulled and displaying the measured trigger displacement as a function of time to the person firing the weapon.

The trigger pull measuring device displays the trigger position as a function of time (i.e. rate of trigger motion) to enable the shooter to diagnose problems in trigger pull technique and thereby eliminate unsteadiness or unevenness in the movement of the trigger. Similarly the method of the present invention provides the shooter with a visual representation of the trigger position and rate of movement as the trigger is operated, allowing the shooter to adjust the trigger pulling motion to achieve a smooth and steady trigger movement and to improve the shooter's control over trigger movement.

These and other advantages will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of a trigger pull measuring device constructed according to the principles of the present invention and adapted for use in the method of the present invention;

FIG. **2** is a side elevation of a first embodiment of a trigger pull measuring device according to the present invention, adapted for use in a weapon of the type employing clips of ammunition;

FIG. **3** is a side elevation of the trigger pull measuring device shown in FIG. **2**, shown as it would appear with the trigger depressed;

FIG. **4** is a side elevation of a second embodiment of a trigger pull measuring device constructed according to the principles of this invention; and,

FIG. **5** is a sample output graph from one of the trigger pull measuring devices of the present invention.

Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A trigger pull measuring device constructed according to the principles of the present invention, indicated generally as **20**, is shown schematically in FIG. **1**. The device **20** is adapted for connection to the trigger mechanism of a weapon (e.g. pistol **22**, shown in phantom) for measuring the rate of trigger pull of the weapon in order to improve trigger pull technique. Although the device is described and illustrated herein in conjunction with pistols, the invention is not so limited and it may be applied to any weapon which is actuated by a trigger. The device comprises means **24** connected to the trigger mechanism for measuring the position of the trigger, and means **26** for displaying the position of the trigger as a function of time. In the preferred embodiment, the means **24** for measuring the position of the trigger comprises a variable resistor **28** having a sliding contact **30**, and means **32** for connecting the sliding contact **30** of the variable resistor **28** to the trigger mechanism so that movement of the trigger moves the sliding contact **30** of the resistor **28**.

The measuring means further comprises means for measuring the resistance of the variable resistor. This preferably includes means for applying a voltage across the variable resistor **28**, such as battery **34**, and a means for measuring the voltage across the variable portion of the resistor **28**. The voltage measuring means is preferably part of a chart recorder **36**. The chart recorder **36** also constitutes means for displaying the position of the

trigger as a function of time. The chart recorder **36** provides a printed graph of trigger position versus time so that any unevenness in trigger motion is readily apparent. For example, fast pulls or jerks on the trigger will show up as vertical lines on the graph and gaps or stops in trigger movement will show up as horizontal lines on the graph.

A first embodiment of the a trigger pull measuring device constructed according to the principles of this invention is indicated generally as **40** in FIGS. **2** and **3**. The device **40** is particularly adapted for use with a weapon of the type employing a magazine or clip for the ammunition. The device **40** comprises a housing **42**, which is preferably the same size and shape as the standard clip or magazine for the weapon. The top portion of housing may be provided with a space **44** to receive one or more rounds, so that the weapon can still be fired. The trigger pull measuring mechanism is disposed in the lower portion of the housing **42**.

The mechanism comprises a variable resistor **46** of the type having a terminal at each end, **48** and **50**, respectively, and a sliding contact **52** for varying the resistance of the resistor **46**. Means, such as wire leads **54** and **56**, connected to terminals **48** and **50**, respectively, are provided for applying a voltage across the variable resistor **46**. For example, wire leads **54** and **56** might be connected to the positive and negative terminals of a battery (not shown). A third wire lead **58** may be electrically connected to the sliding contact **52**. Means such as linkage **60** is provided for connecting the sliding contact **52** of the variable resistor **46** to the trigger mechanism of the weapon so that movement of the trigger moves the sliding contact **52** of the resistor **46**.

The linkage **60** preferably comprises a lever arm **62** pivotally mounted at one end to the housing **42**, and having a first face **64** aligned with an opening **66** in the housing **42** so positioned that when the device **40** is inserted in a weapon, the first face **64** engages a portion of the trigger mechanism that moves in proportion to the movement of the trigger. Thus movement of the trigger will cause the lever arm **62** to pivot (generally clockwise as viewed in FIGS. **2** and **3**). The lever arm **62** further comprises a second face **68** adapted to engage and turn rocker **70**, which is pivotally mounted to the housing **42** with a pin **72**. A link **74** extends between the rocker **70** and the sliding contact **52** of the resistor **46**. Thus, when the trigger mechanism pivots lever am **62**, lever arm **62** engages and turns rocker **70**, which causes link **74** to push the sliding contact **52** of resistor **46**. The sliding contact **52** moves from its rest position shown in FIG. **2** (in which the trigger is in its normal position) to a position such as shown in FIG. **3** (in which the trigger has been moved).

The device further comprises means for measuring the resistance of the variable resistor **46**, for example by measuring the voltage across the variable portion of resistor **46**. The voltage may be measured by the measuring the voltage between wire lead **58** and either of the other wire leads, but preferably lead **56**, which is connected as a common ground. The actual voltage measurement may be made by a chart recorder (not shown) which continuously displays the measured voltage as a function of time. This voltage is representative of the resistance across variable resistor **46**, which in turn is representative of trigger position. The slope of the plot of trigger position versus time shows the rate of trigger movement. A suitable chart recorder for this purpose is the Model Brush 250 chart recorder manufactured by Gould.

The device further comprises means, such as spring **76**, for biasing the sliding contact **52** to its rest position corresponding to zero displacement of the trigger (FIG. **2**), to restore the sliding contact **52** after the trigger is released. Spring **76** is preferably a coil spring one end of which is secured to the sliding contact **52**, and the other end of which is anchored to the housing **42**. For example, the end of the spring **76** may be secured to a tab **78** with a screw **80**.

A second embodiment of the a trigger pull measuring device constructed according to the principles of this invention is indicated generally as 100 in FIG. **4**. The device **100** is shown as it would be mounted on a conventional pistol **102** (shown in phantom) comprising barrel **104**, trigger **106**, and trigger guard **108**. The device **100** comprises a mounting block **110** for mounting the device to the barrel **104** of the pistol **102**, in front of the trigger guard **108**. The device comprises a variable resistor **112** of the type having a terminal at each end, **114** and **116**, respectively, and a sliding contact **118** for varying the resistance of the resistor. Means, such as wire leads **120** and **122** connected to terminals **114** and **116**, respectively, are provided for applying a voltage across the variable resistor **112**. For example, wire leads **120** and **122** might be connected to the positive and negative terminals of a battery. A third wire lead **124** may be electrically connected to the sliding contact **118**. A link **126** is provided for connecting the sliding contact **118** of the variable resistor **112** to the trigger **106** of the pistol **102**, so that movement of the trigger **106** moves the sliding contact **118** of the resistor **112**. The link **126** extends through an opening formed in the the trigger guard **108** for that purpose.

The device further comprises means for measuring the resistance of the variable resistor **112**, for example by measuring the voltage across the variable portion of resistor **112**. The voltage may be measured by the measuring the voltage between wire lead **124** and either of the other wire leads **120** or **122**, but preferably lead **122** which is connected to a common ground. The actual voltage measurement may be made by a chart recorder (not shown) which continuously displays the measured voltage as a function of time. As noted above, a suitable chart recorder is a Model Brush 250 chart recorder manufactured by Gould.

The device **100** further comprises means, such as spring **128**, for biasing the sliding contact **118** to its position corresponding to zero displacement of the trigger **100** (i.e., to the left as viewed in FIG. **4**), to restore the sliding contact **118** after the trigger **100** is released. Spring **128** is preferably a coil spring disposed over the link **124**. One end of the spring **128** engages the exterior of the trigger guard **108** and the other end engages a stop on the link **124**, so that the spring **128** is compressed as link **124** moves (t the right in FIG. **4**) as the trigger moves.

The graph of the trigger position versus time, and the rate of trigger movement (the slope of this line) provides valuable information about the shooter's trigger pull motion. The information is not otherwise readily observable, even by an experienced instructor. FIG. **5** illustrates the graphs of four different trigger pulls **200**, **202**, **204** and **206**.

In graph **200** the plateaus **200***a* and **200***b* indicate points where the shooter stopped motion of the trigger. The downwardly sloped portion **200***c* indicates a point

where the shooter actually allowed the trigger to relax or move backward. The sharp peak **200***d* indicates a timely release of the trigger after the shot, but the flat line **200***e* indicates to much delay between successive shots.

In graph **202** the upwardly sloped portion **202***a* indicates generally smooth and continuous trigger motion, but the substantially vertical portion **202***b* indicates a jerking motion immediately before firing.

In graph **204** the plateaus **204***a*, **204***b*, **204***c*, and **204***d* indicate points where trigger motion halted. The flat peak **204***e* indicates that the trigger was held too long after the shot was fired.

Finally, graph **206** shows a smooth and continuous trigger motion from the start to the firing.

The method of improving trigger pull technique of the present invention a trigger, comprises the steps of continuously measuring trigger displacement as the trigger is pulled and displaying the trigger displacement to the person firing the weapon, preferably as a graph of displacement versus time. The display of trigger displacement provides valuable diagnostic information about defects in the shooter's trigger pull technique. Furthermore the continuous display of the displacement as the shooter is pulling the trigger provides feedback for improving control of trigger pulling.

OPERATION

The device of the present operation is installed on the gun, and the gun is held and fired as a normal gun. For example, in the embodiment shown in FIGS. **2** and **3** the device **40** is inserted into the weapon and the lead wires **54** and **56** connected to the positive and negative terminals of a battery and the lead wires **58** and **56** connected to a chart recorder. As the trigger of the weapon is pulled, the trigger mechanism of the weapon presses on the first face **64** of the lever arm **62**, exposed in opening **66**, causing the lever arm **62** to turn (generally clockwise as shown in FIG. **2**). The motion of the lever arm **62** causes the rocker **70** to pivot (also generally clockwise as shown in FIG. **2**). The pivoting of rocker **70** causes link **74** to move (generally downwardly as shown in FIG. **2**) pushing the sliding contact **52** to the position in FIG. **3**. The motion of the sliding contact **52** causes a change in the resistance of variable resistor **46**. This change in resistance is measured to measure trigger position, and displayed by the chart recorder. Of course some other method of measuring the variable resistance could be used, for example measuring the current through the variable resistor. After the trigger is released, the spring **76** restores the sliding contact **52** to its original position (FIG. **2**).

In the embodiment shown in FIG. **4**, the device **100** is installed on a weapon, with link **126** connected to trigger **106**. The wire leads **120** and **122** are connected to the positive and negative terminals of a battery, and leads **124** and **122** are connected to a chart recorder. Movement of the trigger **106** causes link **126** and thus sliding contact **118** of resistor **112** to move. The motion of the sliding contact **118** causes a change in the resistance of variable resistor **112**. As with device **40**, this changing resistance value can be measured to measure trigger position, and displayed on the chart recorder. After the trigger is released, the spring **128** restores the sliding contact to its original position.

According to the method of this invention, as the shooter pulls the trigger, the trigger displacement is displayed to the shooter, preferably as a graph versus time. Thus, the shooter can try to control trigger movement to produce a smooth and continuous sloped graph of trigger position versus time. Vertical lines indicate pulling the trigger too fast and horizontal lines indicate pulling the trigger to slowly, and downwardly sloped lines indicate releasing the trigger during the trigger stroke.

With this information instructors can instruct the shooter on appropriate corrective measures and the shooter can experiment with different techniques to achieve the desirable smoothly sloped trigger displacement versus time chart.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A trigger pull measuring device adapted for connection to the trigger mechanism of a weapon for measuring the trigger pull of the weapon in order to improve trigger pull technique, the device comprising:

means connected to the trigger mechanism for measuring the instantaneous position of the trigger;

and means for displaying the position of the trigger as a function of time.

2. The trigger pull measuring according to claim **1** wherein the measuring means comprises means for generating an electrical signal proportional to the position of the trigger and means for measuring the electrical signal.

3. A trigger pull measuring device adapted for connection to the trigger mechanism of a weapon for measuring the trigger pull of the weapon in order to improve trigger pull technique, the device comprising:

means connected to the trigger mechanism for measuring the position of the trigger, said means comprising a variable resistor having a sliding contact, and means for connecting the sliding contact of the variable resistor to the trigger mechanism so that movement of the trigger moves the sliding contact of the resistor;

and means for displaying the position of the trigger as a function of time.

4. The trigger pull measuring device according to claim **3** further comprising means for measuring the resistance of the variable resistor.

5. A trigger pull measuring device adapted for connection to the trigger mechanism of a weapon for measuring the trigger pull of the weapon in order to improve trigger pull technique, the device comprising:

a variable resistor having a sliding contact for varying the resistance of the resistor;

means for applying a voltage across the variable resistor;

means for connecting the sliding contact of the variable resistor to the trigger mechanism of the weapon so that movement of the trigger moves the sliding contact of the resistor;

means for measuring the voltage across the variable portion of the variable resistor to measure the position of the trigger.

6. The trigger pull measuring device according to claim 5 further comprising means for displaying a measure of trigger position as a function of time.

7. The trigger pull measuring device according to claim 6 wherein the display means comprises a chart recorder for displaying the measured voltage as a function of time.

8. The trigger pull measuring device according to claim 5 further comprising means for biasing the sliding contact to its position corresponding to no displacement of the trigger, to restore the sliding contact after the trigger is released.

9. The trigger pull measuring device according to claim 5 wherein the means for applying a voltage across the resistor comprises a battery.

10. The trigger pull measuring device according to claim 5, wherein the device is adapted for use in a weapon of the type having a socket for receiving a clip or magazine, the device comprising a support adapted to be received in the socket, wherein the resistor is mounted on the support, and wherein the means for connecting the sliding contact of the resistor to the trigger mechanism comprises a linkage.

11. The trigger pull measuring device according to claim 10 wherein the linkage comprises a first lever arm pivotally mounted at one end and having a first face adapted for engagement with a portion of the trigger mechanism that moves in Proportion to the movement of the trigger, a rocker member adapted to be pivoted by the lever member, and a link extending between the rocker member and the sliding contact of the resistor to move the sliding member as the rocker member pivots.

12. The trigger pull measuring device according to claim 11 further comprising means for biasing the sliding contact to its position corresponding to no displacement of the trigger, to restore the sliding contact after the trigger is released.

13. The trigger pull measuring device according to claim 11 wherein the biasing means comprises a spring one end of which is connected to the sliding contact and the other end of which is anchored to the clip housing.

14. The trigger pull measuring device according to claim 5 wherein the variable resistor is mounted on the exterior of the weapon, and wherein the means for connecting the sliding contact to the trigger mechanism comprises a link extending between the trigger and the sliding contact.

15. The trigger pull measuring device according to claim 14 further comprising means for biasing the sliding contact to its position corresponding to no displacement of the trigger, to restore the sliding contact after the trigger is released.

16. The trigger pull measuring device according to claim 15 wherein the biasing means comprises a coil spring disposed on the link with one end anchored to the link and the other end is anchored to the weapon such that movement of the trigger compresses the coil spring.

17. A trigger pull measuring device adapted for use with a weapon of the type having a socket for receiving a clip or magazine of ammunition, the device adapted for connection to the trigger mechanism of the weapon for measuring the trigger pull of the weapon in order to improve trigger pull technique, the device comprising:

a support configured to be received in the socket of the weapon;

a variable resistor having a sliding contact for varying the resistance of the resistor, mounted on the support;

means for applying a voltage across the variable resistor;

a linkage for connecting the sliding contact of the variable resistor to the trigger mechanism of the weapon when the support is received in the socket so that movement of the trigger moves the sliding contact of the resistor;

means for measuring the voltage across the variable portion of the variable resistor to measure the position of the trigger.

18. The trigger pull measuring device according to claim 17 wherein the linkage comprises a first lever arm pivotally mounted at one end and having a first face adapted for engagement with a portion of the trigger mechanism that moves in proportion to the movement of the trigger, a rocker member adapted to be pivoted by the lever member, and a link extending between the rocker member and the sliding contact of the resistor to move the sliding member as the rocker member pivots.

19. The trigger pull measuring device according to claim 17 further comprising means for biasing the sliding contact to its position corresponding to no displacement of the trigger, to restore the sliding contact after the trigger is released.

20. The trigger pull measuring device according to claim 19 wherein the biasing means comprises a spring one end of which is connected to the sliding contact and the other end of which is anchored to the clip housing.

21. A trigger pull measuring device adapted for connection to the trigger mechanism of a weapon for measuring the trigger pull of the weapon in order to improve trigger pull technique, the device comprising:

a variable resistor having a sliding contact for varying the resistance of the resistor, mounted on the weapon;

means for applying a voltage across the variable resistor;

a link for connecting the sliding contact of the variable resistor to the trigger of the weapon so that movement of the trigger moves the sliding contact of the resistor;

means for measuring the voltage across the variable portion of the variable resistor to measure the position of the trigger.

22. The trigger pull measuring device according to claim 21 further comprising means for biasing the sliding contact to its position corresponding to no displacement of the trigger, to restore the sliding contact after the trigger is released, said biasing means comprising a coil spring disposed on the link with one end anchored to the link and the other end is anchored to the weapon such that movement of the trigger compresses the coil spring.

23. A method of improving trigger pull technique for firing a weapon with a trigger, the method comprising the steps of:

continuously measuring the instantaneous position of the trigger as the trigger is pulled;

displaying the instantaneous position of the trigger to the person firing the weapon.

24. The method according to claim 23 wherein the step of displaying the trigger displacement comprises displaying a graph of trigger displacement versus elapsed time.

25. A method of improving trigger pull technique for firing a weapon with a trigger, the method comprising the steps of:

connecting the trigger mechanism to the sliding contact of a variable resistor so that movement of the trigger moves the sliding contact of the resistor;

continuously measuring the resistance of the variable resistor to measure displacement of the trigger; and

displaying the trigger displacement to the person firing the weapon.

26. The method according to claim 25 wherein the step of measuring the resistance of the variable resistor comprises the steps of:

applying a voltage across the resistor;

measuring the voltage across the variable part of the resistor.

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